

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 1218**

Roll No.

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**B. Tech.**

(For AU/BT/CE/CH/EV/FT/ME/MF/PE/TT/TX)

**(Semester-II) Even Semester Theory Examination, 2012-13****ENGINEERING PHYSICS-II(M)****Time : 3 Hours]****[Total Marks : 80****Note :** Attempt questions from each Section as per instructions.**Section-A**Attempt *all* parts of this question. Each part carries 2 marks.

2×8=16

1. (a) What do you understand by wave packet?
- (b) Explain, why electron can not reside inside nucleus.
- (c) What is Meissner effect?
- (d) What is dielectric loss?
- (e) What do you mean by coercivity?
- (f) Describe inter-planer spacing in crystal structure.
- (g) What is enthalpy?
- (h) What are thermistors?

**Section-B**Attempt any *three* parts of this question. Each part carries 8 marks.

8×3=24

2. (a) Calculate the de-Broglie wavelength associated with a proton moving with a velocity equal to one-twentieth of the velocity of light.
- (b) The critical fields at 6K and 8K for NbTi alloys are 7.616 and 4.284 MA/m. respectively. Calculate the transition temperature and the critical field at 0 K.
- (c) Calculate the electronic polarizability of argon atom at NTP, the dielectric constant of argon is 1.0024 and its atomic density is  $2.7 \times 10^{25}$  atoms/m<sup>3</sup>.
- (d) Translation vectors of the unit cell of a crystal are 1.2 Å, 1.8 Å and 2.0 Å. A lattice plane (231) makes the intercept of length 1.2 Å on the X-axis. Find the length of the intercepts on y and z axis.

- (e) The compressor of an air expansion machine intakes air at 1 atmosphere and releases at 5 atmosphere pressure. Calculate the coefficient of performance of the machine. If the power necessary to drive the machine is 1.5 H.P., find the amount of heat removed per minute.  $\gamma$  for air is 1.4.

### Section-C

Attempt *all* questions of this Section. Each question carries 8 marks.  $8 \times 5 = 40$

3. Attempt any one part of the following :
- What are phase and group velocity? Establish a relation between them in terms of frequency.
  - A particle is moving along a line between  $x=0$  and  $x=a$  with zero potential energy. At point for which  $x < 0$  and  $x > a$ , the potential energy is infinite. Solving Schrödinger's equation, obtain the energy, eigenvalues and the normalized wave function for the particle.
4. Attempt any one part of the following :
- What do you mean by superconductivity? Explain the BCS theory of superconductors and give some applications of superconductors.
  - What are nonomaterials? Discuss preparation technique and properties of Buckyball.
5. Attempt any one part of the following :
- Discuss frequency dependence of dielectric constant. What is relaxation time?
  - What is diamagnetism? Show that susceptibility of diamagnetic material is negative and independent of temperature.
6. Attempt any one part of the following :
- What do you understand by space lattice? Describe the seven systems of crystals. Mention and explain with examples the types of lattices in a cubic system.
  - Discuss Lau's principle of X-ray diffraction and obtain the diffraction condition for a simple cubic lattice.
7. Attempt any one part of the following :
- Explain the theory of Joule Thomson regenerative cooling. How can you obtain liquid helium by its application?
  - Describe the working of a rotatory oil pump for producing low pressure. How are these pressure measured?

### Physical constants :

Speed of light	$c = 3.0 \times 10^8 \text{ m/s}$
Planck's constant	$h = 6.62 \times 10^{-34} \text{ J-s}$
Mass of electron	$m = 9.1 \times 10^{-31} \text{ kg}$
Mass of proton	$m_p = 1.67 \times 10^{-27} \text{ kg}$
Permeability	$\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$
Permittivity	$\epsilon_0 = 8.854 \times 10^{-12} \text{ F/m}$